



Global Precipitation Products at NASA GES DISC for Supporting Agriculture Research and Applications

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The Sixth International Conference on Agro-Geoinformatics



Outline

- Introduction
- Global precipitation products at GES DISC
- Data services
- Giovanni
- Summary

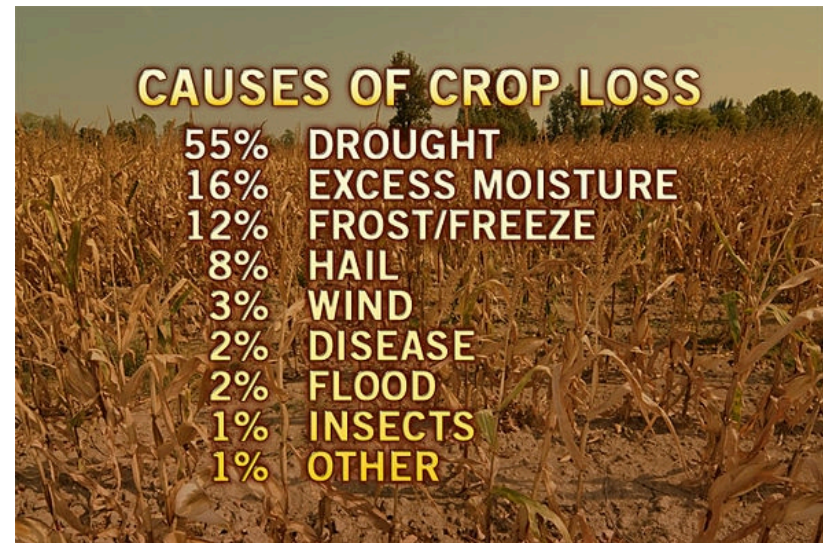


Introduction

- Key environmental variables for agriculture: precipitation, temperature, water (soil moisture), solar radiation, NDVI, etc.
- Rainfed agriculture – major farming practices that rely on rainfall for water.
- Rainfed agriculture: >95% of farmed land (sub-Saharan Africa); 90% (Latin America); 75% (Near East and North Africa); 65% (East Asia); 60% (South Asia).
- Precipitation is very important for rainfed agriculture. Droughts can cause severe damage. Precipitation information can be used to monitor the growing season.
- The Goddard Earth Sciences (GES) Data and Information Services Center (DISC), one of 12 NASA data centers, located in Greenbelt, Maryland, USA.
- The GES DISC is a major data archive center for global precipitation, water & energy cycles, atmospheric composition, and climate variability.



In Kenya 2016 <http://venturesafrica.com/kenya-battles-drought/>



In the U.S. <https://www.scientificamerican.com/article/heat-drought-continues-threaten-us-corn-crops/>



Rainfall Product Overview

- GPM (Global Precipitation Measurement)
- TRMM (Tropical Rainfall Measuring Mission)
- GPCP (Global Precipitation Climatology Project) of MEaSUREs
- MERRA-2 (Modern-Era Retrospective analysis for Research and Applications, Version 2)
- NLDAS (North America Land Data Assimilation System)
- FLDAS (Famine Early Warning System Network Land Data Assimilation System)
- GLDAS (Global Land Data Assimilation System).



Global Precipitation Products at NASA GES DISC

- Single sensor (microwave, radar, and combined) products from TRMM (Tropical Rainfall Measuring Mission; 1997 - 2015) and GPM (Global Precipitation Measurement; 2014 - present): orbital and gridded (algorithms, case studies, etc.)
- TRMM Multi-satellite Precipitation Analysis (TMPA, 0.25-deg. 3-hr, monthly, 1998 – present)
- Integrated Multi-satellitE Retrievals for GPM (IMERG, 0.1-deg., 0.5-hr, monthly, 2014 – present). Version 4 is coming soon
- GPCP (Global Precipitation Climatology Project). Version-3 is coming soon)
- GLDAS (Global Land Data Assimilation System, 0.25-deg., 3-hourly and 1-deg., monthly, 1948-2010 (v 2.0), 2000-present (v 2.1))
- NLDAS (North America Land Data Assimilation System, 0.125-deg., hourly and monthly, 1979 - present)
- FLDAS (Famine Early Warning System Network Land Data Assimilation System, 0.1 deg., daily, monthly, 1982 – present)
- MERRA-2 (Modern-Era Retrospective analysis for Research and Applications, Version-2, 0.5 x 0.625 deg. hourly, 3-hourly, monthly, 1980-present)



Not Entirely Independent

- TMPA (PMW, IR, GPCC, etc.)
- IMERG (PMW, IR, GPCC, etc.)
- GPCC (gauges only, sampling)
- GPCP (PMW, IR, GPCC, etc.)
- GLDAS (TMPA, PERSIANN, CMAP, CMORPH, NRL, GTS)
- MERRA-2 (CMAP, GPCP)



Issues in Satellite-based Precipitation Estimates

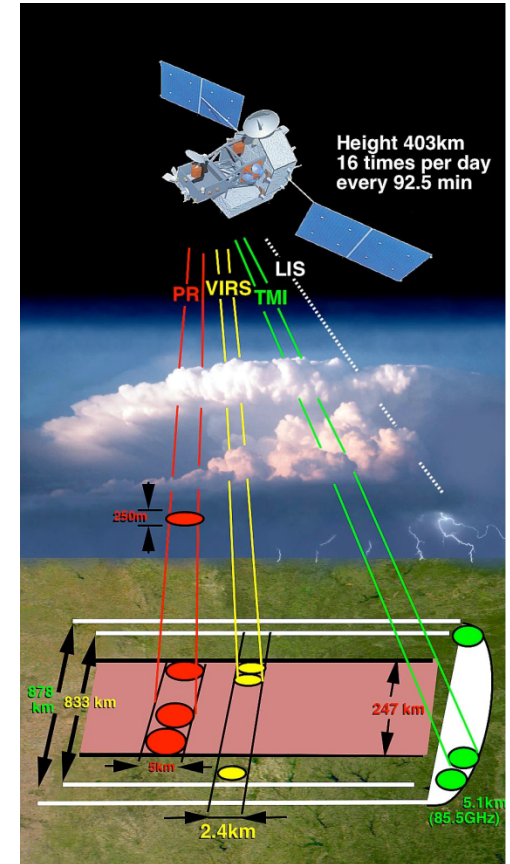
- Over oceans, passive microwave (PMW) retrievals are found to rival radar retrievals. Over land, more difficult (variations of the surface emissivity, in particular over snow and ice)
- IR techniques related cloud top temperatures to surface rainfall (underestimation of warm rain, false alarms for anvils and thick cirrus clouds with cloud brightness temperatures)
- Precipitation radar: Attenuation correction, complex terrain and minimum detectable signals (snow, light rain, etc.)
- Algorithm changes; multi-satellite, multi-sensor, multi-algorithms, etc.
- Complex terrains, orographic effect, snow and ice surface, lacking gauges and radars, light rain, blowing snow, etc.
- Lack of ground observations for bias correction

Some contents from: <http://trmm.chpc.utah.edu/>



TRMM (Tropical Rainfall Measuring Mission)

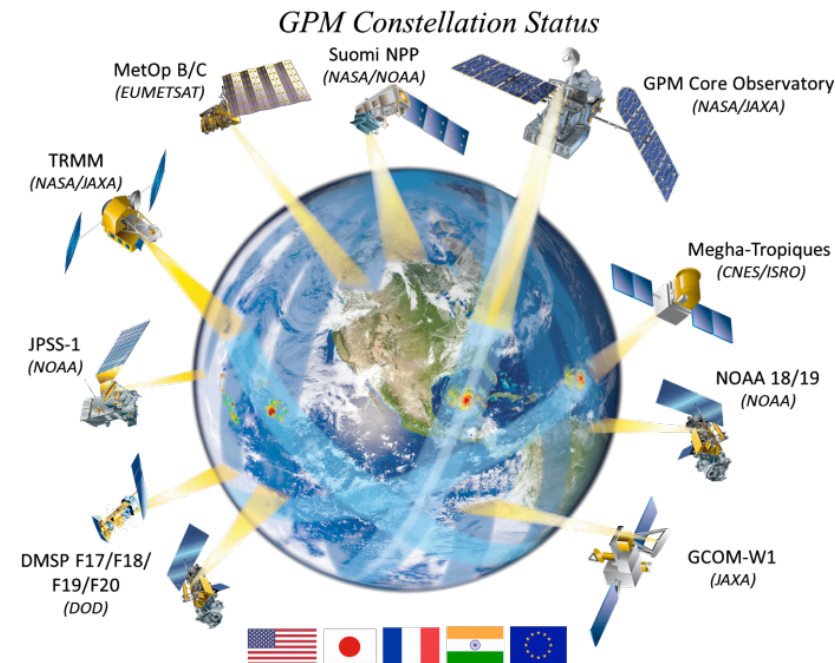
- NASA/JAXA mission (Nov. 1997 – Apr. 2015) to monitor and study tropical rainfall
- Precipitation related instruments (TMI, PR, LIS, VIRS)
- Orbital and gridded datasets
- Single sensor, multi-sensor, multi-satellite datasets.





GPM (Global Precipitation Measurement)

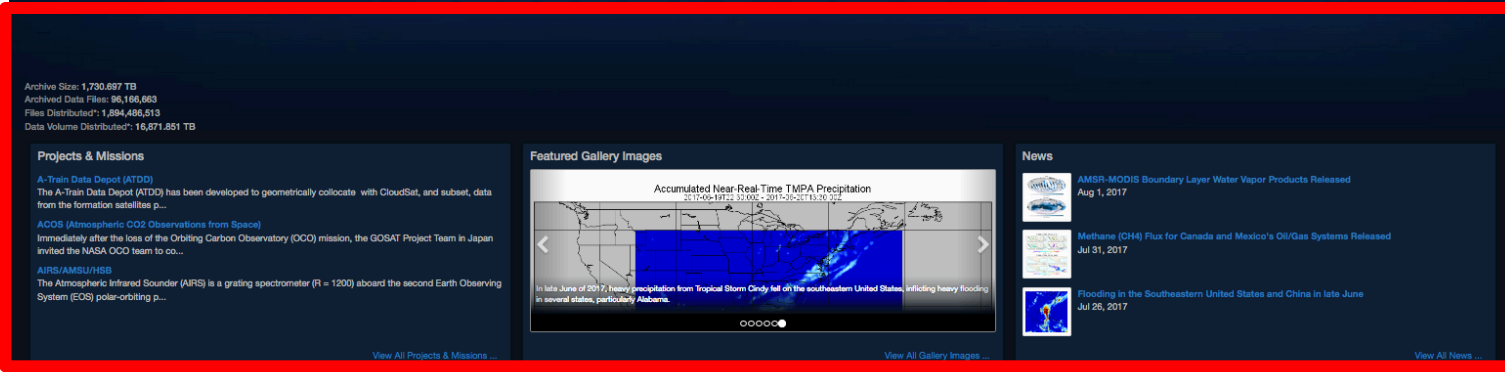
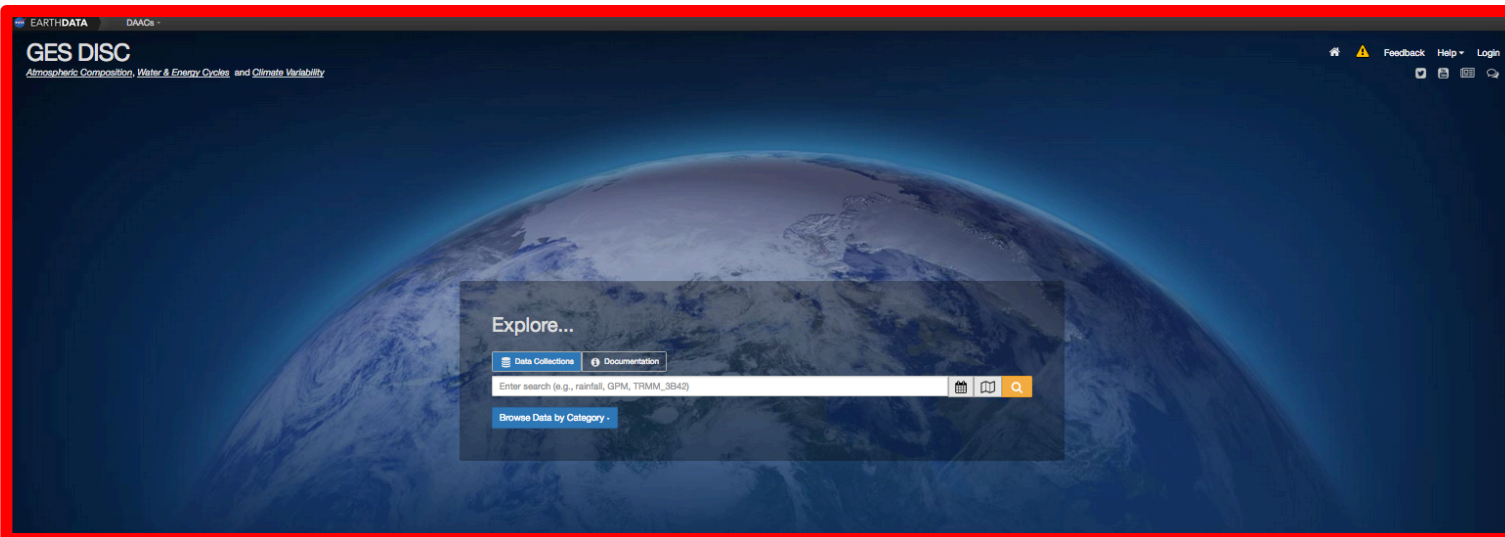
- NASA/JAXA mission (Feb. 2014 – present) to monitor and study global precipitation (rain and snow)
- Quantify rainfall rates from 0.22 mm h^{-1} to 110 mm h^{-1} (60 mm h^{-1} for microwave imager) and detect falling snow at instrument footprint scales (from Walter Petersen)
- Precipitation related instruments (GMI, PR)
- GPM constellation of international satellites
- Orbital and gridded datasets. Single sensor, multi-sensor, multi-satellite datasets.





Data Services (How to find data?)

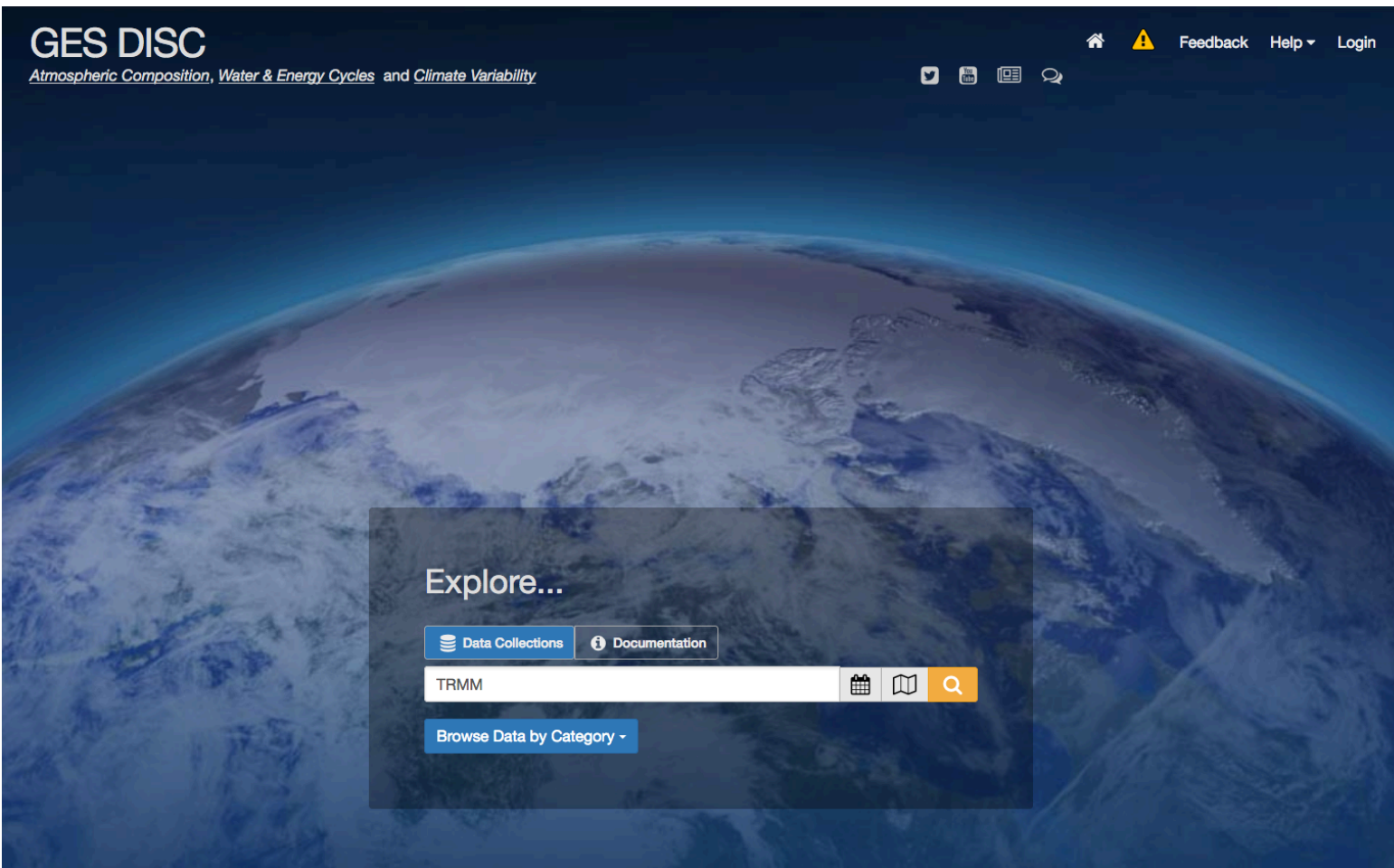
- Newly designed Web interface





Data Services

- <https://disc.gsfc.nasa.gov/uui/datasets?keywords=TRMM> (GPM, NLDA, GLDAS, MERRA)





Data Services

EARTHDATA DAACs

GES DISC

Atmospheric Composition, Water & Energy Cycles and Climate Variability

TRMM

Feedback Help Login

Data Collections Documentation

Showing 1 - 32 of 39 datasets associated with TRMM

Refine By

Subject Sort ▾

- ☐ Atmospheric Phenomena (1)
- ☐ Atmospheric Radiation (8)
- ☐ Atmospheric Temperature (6)
- ☐ Atmospheric Water Vapor (2)
- ☐ Atmospheric Winds (7)

[More...](#)

Measurement Sort ▾

- ☐ Atmospheric Heating (7)
- ☐ Attitude Characteristics (4)
- ☐ Brightness Temperature (1)
- ☐ Cloud Liquid Water/Ice (8)
- ☐ Cloud Microphysics (8)

[More...](#)

Source Sort ▾

- ☐ AQUA AMSR-E (4)
- ☐ DMSP 5D-2/F13 SSM/I (1)
- ☐ DMSP 5D-2/F14 SSM/I (1)
- ☐ DMSP 5D-2/F15 SSM/I (1)
- ☐ DMSP 5D-3/F16 SSMIS (2)

[More...](#)

Processing Level Sort ▾

- ☐ 1 (1)
- ☐ 1A (2)
- ☐ 1B (3)
- ☐ 2 (7)
- ☐ 3 (26)

Project Sort ▾

- ☐ CWIC (2)
- ☐ EOS (2)
- ☐ EOSDIS (4)
- ☐ ESIP (4)

Image	Dataset ▾	Source ▴	Temporal Resolution ▾	Spatial Resolution ▾	Process Level ▾	Begin Date ▾	End Date ▾
 Hover	TRMM Attitude and VIRS Packets and Header Record L1A V7 (TRMM_1A01.7) - Infrared Wavelengths, Platform Characteristics, Sensor Characteristics ▾	TRMM VIRS	90 minutes	2.2 km x 2.2 km	1A	1997-12-20	2014-03-22
 Hover	TRMM Visible and Infrared Scanner Calibrated Radiances L1B 1.5 hours V7 (TRMM_1B01.7) - Infrared Wavelengths, Platform Characteristics, Sensor Characteristics ▾	TRMM VIRS	90 minutes	2.2 km x 2.2 km	1B	1997-12-20	2014-03-22
 Hover	TMI/TRMM surface soil moisture (LPRM) L2 V001 (LPRM_TMI_SOILM2.001) - Surface Thermal Properties, Soils, Vegetation	TRMM TMI		45 km x 45 km	2	1997-12-07	2015-04-09
 Hover	TMI/TRMM surface soil moisture (LPRM) L3 1 day 25 km x 25 km daytime V001 (LPRM_TMI_DY_SOILM3.001) - Surface Thermal Properties, Soils, Vegetation	TRMM TMI	1 day	25 km x 25 km	3	1997-12-07	2015-04-09
 Hover	TMI/TRMM surface soil moisture (LPRM) L3 1 day 25 km x 25 km nighttime V001 (LPRM_TMI_NT_SOILM3.001) - Surface Thermal Properties, Soils, Vegetation	TRMM TMI	1 day	25 km x 25 km	3	1997-12-07	2015-04-09



Data Services

EARTHDATA

DAACs ▾

GES DISC

3b43

Feedback

Help ▾

Login

Atmospheric Composition, Water & Energy Cycles and Climate Variability

Go to Search Results

TRMM_3B43: TRMM (TMPA/3B43) Rainfall Estimate L3 1 month 0.25 degree x 0.25 degree V7

The 3B43 dataset is the monthly version of the 3B42 dataset.

This product is created using TRMM-adjusted merged microwave-infrared precipitation rate (in mm/hr) and root-mean-square (RMS) precipitation-error estimates.

It provides a "best" precipitation estimate in a latitude band covering 50° N to 50° S, an expansion of the TRMM region, from all global data sources, namely high-quality microwave data, infrared data, and analyses of rain gauges. The granule size is one month.

Data Access

Online Archive

Search ▾

Simple Subset Wizard

Web Services ▾

Product Summary

[Data Citation](#) [Documentation](#)

Shortname: TRMM_3B43

Longname: TRMM (TMPA/3B43) Rainfall Estimate L3 1 month 0.25 degree x 0.25 degree V7

Version: 7

Format: HDF

Spatial Coverage: -180.0,-50.0,180.0,50.0

Temporal Coverage: 1998-01-01 to present

File Size: 4.9 MB per file

Data Resolution

Spatial: 0.25 ° x 0.25 °

Temporal: 1 month

GES - DISC
Goddard Earth Sciences
Data Information Services Center

Liu, Zhong (GSFC-610.2)[GEORGE MASON UNIVERSITY] Thursday, August 3, 2017 at 5:29:18 PM Eastern Daylight Time



Data Services

- Dataset and information search
- Subsetting (spatial and parameter)
- Format conversion (NetCDF, ASCII)
- Time series (Data Rods)
- Machine to machine (OPeNDAP, https, TRHEDDS, GDS)
- GIS support (in-house GIS specialists)
- Online visualization and analysis (explore and evaluate datasets without downloading software and data)



Data Services

Archive Size: 1,730.758 TB
Archived Data Files: 96,172,819
Files Distributed*: 1,894,565,309
Data Volume Distributed*: 16,872.623 TB

Projects & Missions

A-Train Data Depot (ATDD)

The A-Train Data Depot (ATDD) has been developed to geometrically collocate with CloudSat, and subset, data from the formation satellites p...

ACOS (Atmospheric CO2 Observations from Space)

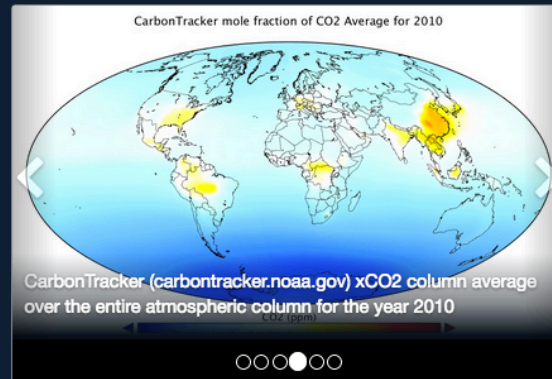
Immediately after the loss of the Orbiting Carbon Observatory (OCO) mission, the GOSAT Project Team in Japan invited the NASA OCO team to co...

AIRS/AMSU/HSB

The Atmospheric Infrared Sounder (AIRS) is a grating spectrometer (R = 1200) aboard the second Earth Observing System (EOS) polar-orbiting p...

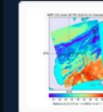
[View All Projects & Missions ...](#)

Featured Gallery Images

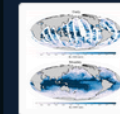


[View All Gallery Images ...](#)

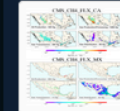
News



Suomi NPP CrIS Full Spectral Resolution (FSR) Level 1B Data Products Released
Aug 2, 2017



AMSR-MODIS Boundary Layer Water Vapor Products Released
Aug 1, 2017



Methane (CH4) Flux for Canada and Mexico's Oil/Gas Systems Released
Jul 31, 2017

[View All News ...](#)

Science Focus Areas

Atmospheric Composition
Water & Energy Cycles
Climate Variability

Tools

Giovanni
MERRA Subsetter
Data Rods for Hydrology
DQViz
AIRS NRT Viewer
OGC Web Map Service
OPeNDAP and GDS

Resources

HowTo
Glossary
FAQ
News
Gallery
Alerts

About Us

Who We Are
Citing Our Data
Contact Us





User Services

- FAQs, How to (recipes), Glossary, etc.
- Social media (Twitter, YouTube, User forum)
- Help desk (phone, email, online feedback)
- Training materials (ARSET => Applied Remote Sensing Training)

Giovanni (<https://giovanni.gsfc.nasa.gov>) - Data Visualization and analysis without downloading data and software)

The Bridge Between Data and Science v 4.22
[Release Notes](#)
[Browser Compatibility](#)
[Known Issues](#)

MODIS OPeNDAP server continuing problem ... [1 of 2 messages]
[Read More](#)

Select Plot

☒ Maps: Time Averaged Map ▾
☐ Comparisons: Select... ▾
☐ Vertical: Select... ▾
☐ Time Series: Select... ▾
☐ Miscellaneous: Select... ▾

Select Date Range (UTC)

YYYY-MM-DD HH:mm

- - 📅 00 : 00

to

- - 📅 23 : 59

Valid Range: 1948-01-01 to 2017-08-02

Select Region (Bounding Box or Shape)

Format: West, South, East, North

Please specify a start date.

Select Variables

▼ Disciplines

☐ Atmospheric Dynamics (16)
☐ Cryosphere (1)
☐ Hydrology (98)
☐ Water and Energy Cycle (82)

▼ Measurements

☐ Atmospheric Moisture (1)
☐ Cloud Properties (1)
☐ Precipitation Anomaly (2)
☐ Precipitation (107)
☐ Snow/Ice (5)

► Platform / Instrument

► Spatial Resolutions

► Temporal Resolutions

► Wavelengths

► Special Features

► Portal

Number of matching Variables: 112 of 1671
Total Variable(s) included in Plot: 0
Please select at least 1 variable

Keyword :

	Variable	Source	Temp.Res.	Spat.Res.	Begin Date	End Date	Units	Vert. Slice
<input type="checkbox"/>	Rainfall (unfrozen precipitation) (NLDAS_NOAH0125_M_v002)	NLDAS Model	Monthly	0.125 °	1979-01-02	2017-06-30	kg/m^2	-
<input type="checkbox"/>	Snowfall (frozen precipitation) (NLDAS_NOAH0125_M_v002)	NLDAS Model	Monthly	0.125 °	1979-01-02	2017-06-30	kg/m^2	-
<input type="checkbox"/>	Rainfall (unfrozen precipitation) (NLDAS_MOS0125_M_v002)	NLDAS Model	Monthly	0.125 °	1979-01-02	2017-06-30	kg/m^2	-
<input type="checkbox"/>	Snowfall (frozen precipitation) (NLDAS_MOS0125_M_v002)	NLDAS Model	Monthly	0.125 °	1979-01-02	2017-06-30	kg/m^2	-
<input type="checkbox"/>	Near-Real-Time Precipitation Rate (TRMM_3B42RT_v7)	TRMM	3-hourly	0.25 °	2003-03-01	2017-08-02	mm/hr ▾	-
<input type="checkbox"/>	Precipitation monthly total (NLDAS_FOR0125_M_v001)	NLDAS Model	Monthly	0.125 °	1996-08-01	2007-12-31	kg/m^2	-
<input type="checkbox"/>	Precipitation monthly total (NLDAS_FORB0125_M_v002)	NLDAS Model	Monthly	0.125 °	1979-01-01	2017-06-30	kg/m^2 ▾	-
<input type="checkbox"/>	Rainfall (unfrozen precipitation) (NLDAS_VIC0125_M_v002)	NLDAS Model	Monthly	0.125 °	1979-01-02	2017-06-30	kg/m^2	-
<input type="checkbox"/>	Snowfall (frozen precipitation) (NLDAS_VIC0125_M_v002)	NLDAS Model	Monthly	0.125 °	1979-01-02	2017-06-30	kg/m^2	-
<input type="checkbox"/>	Precipitation hourly total (NLDAS_FOR0125_H_v001)	NLDAS Model	Hourly	0.125 °	1996-08-01	2007-12-31	kg/m^2	-
<input type="checkbox"/>	Precipitation monthly total (convective) (NLDAS_FORB0125_M_v002)	NLDAS Model	Monthly	0.125 °	1979-01-01	2017-06-30	kg/m^2	-
<input type="checkbox"/>	Total precipitation rate (GLDAS_NOAH10_M_v2.0)	GLDAS Model	Monthly	1 °	1948-01-01	2010-12-31	kg m-2 s-1	-
<input type="checkbox"/>	Total precipitation rate (GLDAS_NOAH025_M_v2.0)	GLDAS Model	Monthly	0.25 °	1948-01-01	2010-12-31	kg m-2 s-1	-
<input type="checkbox"/>	Climatology (1980-2009) of Precipitation monthly total (NLDAS_FORA0125_MC_v002)							

Help

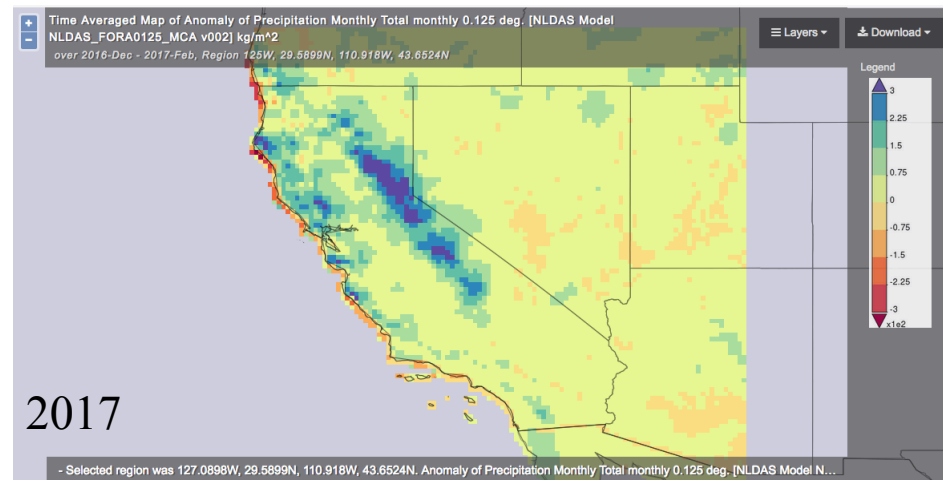
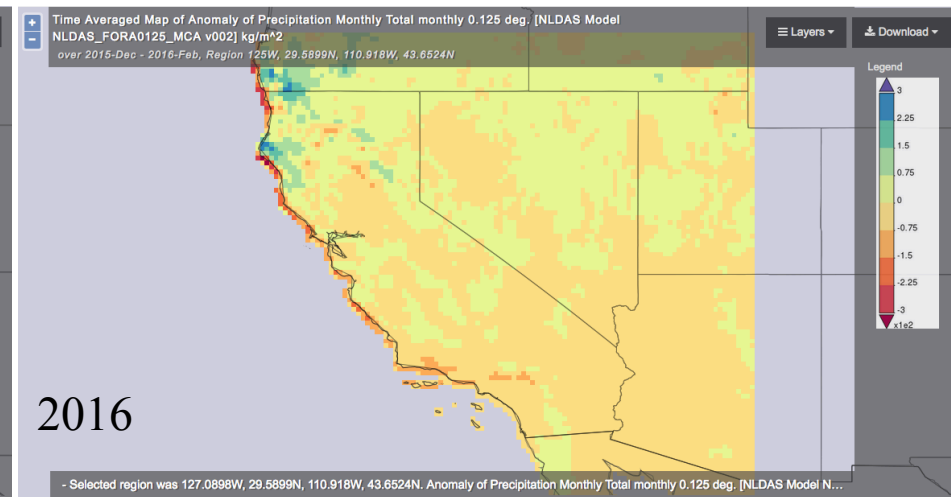
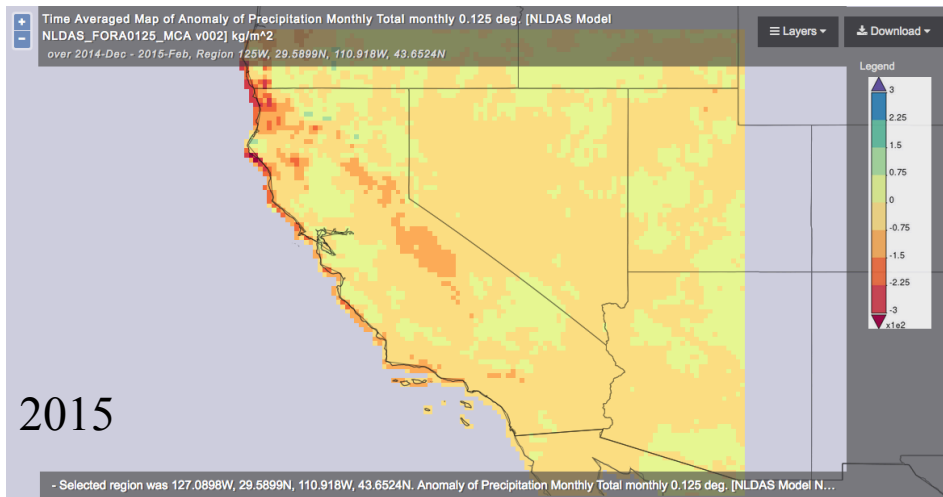
Reset

Feedback

Plot Data



Examples (California Droughts)

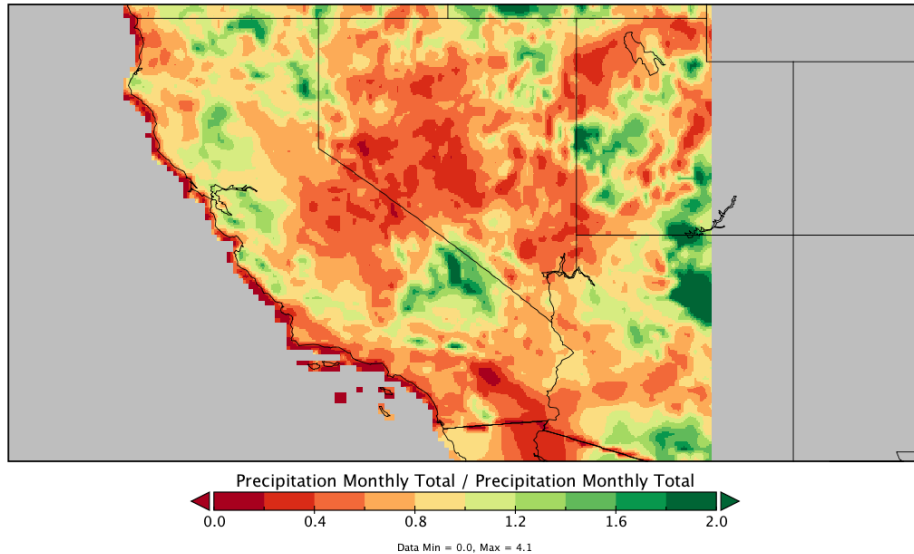


NLDAS Total Precipitation
Anomaly in Giovanni

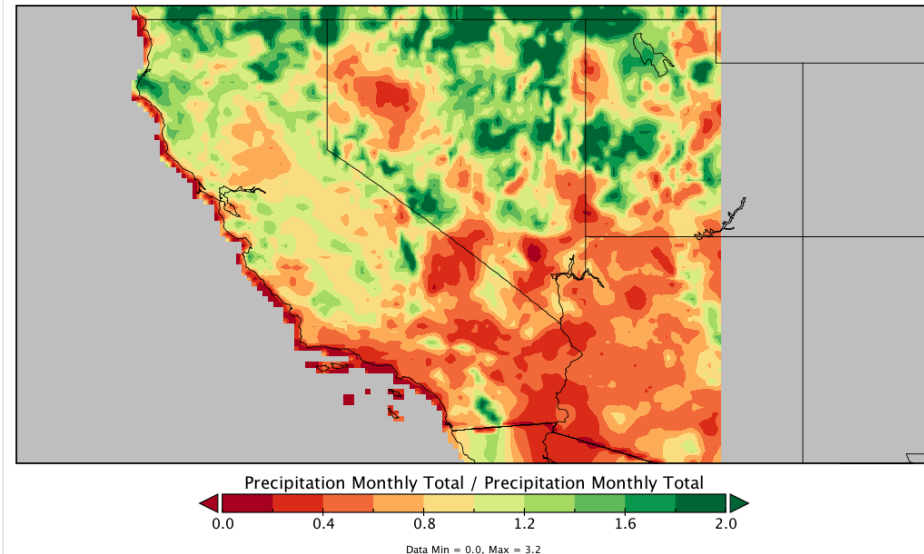


Examples (California Droughts)

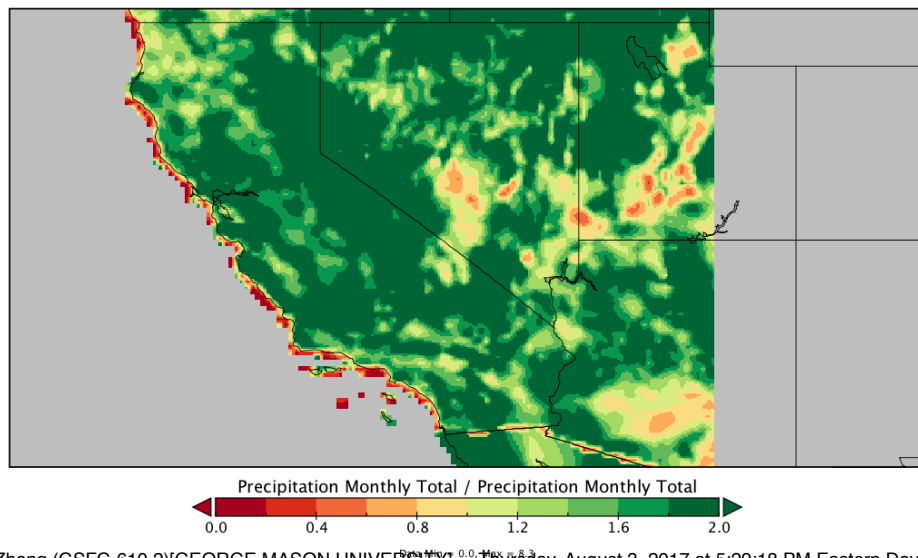
Winter Precipitation Monthly Total (2014-15) / Climatology



Winter Precipitation Monthly Total (2015-16) / Climatology



Winter Precipitation Monthly Total (2016-17) / Climatology



NLDAS Total Precipitation



Summary

- Global and regional precipitation datasets (satellite-based and data assimilation)
- Data services (subsetting, format conversion, online visualization, etc.)
- User services are available



Information

- Data information and services:
<https://disc.sci.gsfc.nasa.gov/> Search for:
TRMM (GPM, TRMM, NLDAS, GLDAS, MERRA)
- Giovanni: <https://giovanni.gsfc.nasa.gov> or
Google search “NASA giovanni” Search
“GPM”, “TRMM”, “MERRA”, “GLDAS”
- Comments and suggestions: gsfc-help-disc@lists.nasa.gov